General

Guideline Title

2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease.

Bibliographic Source(s)

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Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Definitions for the level of the evidence (A-C) and classes of recommendations (I-III) are provided at the end of the "Major Recommendations" field.

Introduction

Vital Importance of Involvement by an Informed Patient

Class I

1. Choices about diagnostic and therapeutic options should be made through a process of shared decision making involving the patient and provider, with the provider explaining information about risks, benefits, and costs to the patient. (Level of Evidence: C)

Diagnosis of Stable Ischemic Heart Disease (SIHD)

Clinical Evaluation of Patients with Chest Pain

Clinical Evaluation in the Initial Diagnosis of SIHD in Patients with Chest Pain

Class I

1. Patients with chest pain should receive a thorough history and physical examination to assess the probability of ischemic heart disease (IHD) before additional testing (Diamond & Forrester, 1979). (Level of Evidence: C)
2. Patients who present with acute angina should be categorized as stable or unstable; patients with unstable angina (UA) should be further categorized as being at high, moderate, or low risk (Jneid et al., 2012; Wright et al., 2011). (Level of Evidence: C)

Electrocardiography

Resting Electrocardiography to Assess Risk

Class I

1. A resting electrocardiogram (ECG) is recommended in patients without an obvious, noncardiac cause of chest pain (Daly et al., 2006; Daly et al., 2003; Hammermeister, DeRouen, & Dodge, 1979). (Level of Evidence: B)

Noninvasive Testing for Diagnosis of IHD

Stress Testing and Advanced Imaging for Initial Diagnosis in Patients with Suspected SIHD Who Require Noninvasive Testing

See Table 11 in the original guideline document for a summary of recommendations from this section.

Able to Exercise

Class I

1. Standard exercise ECG testing is recommended for patients with an intermediate pretest probability of IHD who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity (Sabharwal et al., 2007; Gianrossi et al., 1989; Kwok et al., 1999; Shaw et al., 2011). (Level of Evidence: A)
2. Exercise stress with nuclear myocardial perfusion imaging (MPI) or echocardiography is recommended for patients with an intermediate to high pretest probability of IHD who have an *un*interpretable ECG and at least moderate physical functioning or no disabling comorbidity (Fleischmann et al., 1998; Garber & Solomon, 1999; Biagini et al., 2006; Geleijnse et al., 2007; Imran, Palinkas, & Picano, 2003; Mahajan et al., 2010; Marcassa et al., 2008; Nandalur et al., 2007; Picano, Molinaro, & Pasanisi, 2008; Underwood et al., "Myocardial perfusion scintigraphy and cost effectiveness," 2004; Underwood et al., "Myocardial perfusion scintigraphy: the evidence," 2004). (Level of Evidence: B)

Class IIa

1. For patients with a low pretest probability of obstructive IHD who do require testing, standard exercise ECG testing can be useful, provided the patient has an interpretable ECG and at least moderate physical functioning or no disabling comorbidity. (Level of Evidence: C)
2. Exercise stress with nuclear MPI or echocardiography is reasonable for patients with an intermediate to high pretest probability of obstructive IHD who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity (Fleischmann et al., 1998; Garber & Solomon, 1999; Biagini et al., 2006; Geleijnse et al., 2007; Imran, Palinkas, & Picano, 2003; Mahajan et al., 2010; Marcassa et al., 2008; Nandalur et al., 2007; Picano, Molinaro, & Pasanisi, 2008; Underwood et al., "Myocardial perfusion scintigraphy and cost effectiveness," 2004; Underwood et al., "Myocardial perfusion scintigraphy: the evidence," 2004). (Level of Evidence: B)
3. Pharmacological stress with cardiac magnetic resonance (CMR) can be useful for patients with an intermediate to high pretest probability of obstructive IHD who have an *un*interpretable ECG and at least moderate physical functioning or no disabling comorbidity (Nandalur et al., 2007; Hamon et al., 2010; Schuetz et al., 2010). (Level of Evidence: B)

Class IIb

1. Coronary/cardiac computed tomography angiography (CCTA) might be reasonable for patients with an intermediate pretest probability of IHD who have at least moderate physical functioning or no disabling comorbidity (Schuetz et al., 2010; Budoff et al., 2008; Hamon et al., 2006; Janne d'Othee et al., 2008; Meijboom et al., 2008; Miller et al., 2008; Schuijf et al., 2006; Stein et al., 2006; Sun & Jiang, 2006). (Level of Evidence: B)
2. For patients with a low pretest probability of obstructive IHD who do require testing, standard exercise stress echocardiography might be reasonable, provided the patient has an interpretable ECG and at least moderate physical functioning or no disabling comorbidity. (Level of Evidence: C)

Class III: No Benefit

1. Pharmacological stress with nuclear MPI, echocardiography, or CMR is not recommended for patients who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity (Underwood et al., "Myocardial perfusion scintigraphy and cost effectiveness," 2004; Underwood et al., 1999; Nucifora et al., 2011). (Level of Evidence: C)
2. Exercise stress with nuclear MPI is not recommended as an initial test in low-risk patients who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity. (Level of Evidence: C)

Unable To Exercise

Class I

1. Pharmacological stress with nuclear MPI or echocardiography is recommended for patients with an intermediate to high pretest probability of IHD who are incapable of at least moderate physical functioning or have disabling comorbidity (Biagini et al., 2006; Geleijnse et al., 2007; Imran, Palinkas, & Picano, 2003; Marcassa et al., 2008; Nandalur et al., 2007; Picano, Molinaro, & Pasanisi, 2008; Underwood et al., "Myocardial perfusion scintigraphy and cost effectiveness," 2004; Underwood et al., "Myocardial perfusion scintigraphy: the evidence," 2004). (Level of Evidence: B)

Class IIa

1. Pharmacological stress echocardiography is reasonable for patients with a low pretest probability of IHD who require testing and are incapable of at least moderate physical functioning or have disabling comorbidity. (Level of Evidence: C)
2. CCTA is reasonable for patients with a low to intermediate pretest probability of IHD who are incapable of at least moderate physical functioning or have disabling comorbidity (Schuetz et al., 2010; Budoff et al., 2008; Hamon et al., 2006; Janne d'Othee et al., 2008; Meijboom et al., 2008; Miller et al., 2008;

Schuijf et al., 2006; Stein et al., 2006; Sun & Jiang, 2006). (Level of Evidence: B)

3. Pharmacological stress CMR is reasonable for patients with an intermediate to high pretest probability of IHD who are incapable of at least moderate physical functioning or have disabling comorbidity (Nandalur et al., 2007; Hamon et al., 2010; Schuetz et al., 2010; Greenwood et al., 2012; Hundley et al., 1999; Nagel et al., 1999; Schwitter et al., 2008). (Level of Evidence: B)

Class III: No Benefit

1. Standard exercise ECG testing is not recommended for patients who have an *un*interpretable ECG or are incapable of at least moderate physical functioning or have disabling comorbidity (Fleischmann et al., 1998; Garber & Solomon, 1999; Biagini et al., 2006; Geleijnse et al., 2007; Imran, Palinkas, & Picano, 2003; Mahajan et al., 2010; Marcassa et al., 2008; Nandalur et al., 2007; Picano, Molinaro, & Pasanisi, 2008; Underwood et al., "Myocardial perfusion scintigraphy and cost effectiveness," 2004; Underwood et al., "Myocardial perfusion scintigraphy: the evidence," 2004; Janne d'Othee et al., 2008). (Level of Evidence: C)

Other

Class IIa

1. CCTA is reasonable for patients with an intermediate pretest probability of IHD who a) have continued symptoms with prior normal test findings, or b) have inconclusive results from prior exercise or pharmacological stress testing, or c) are unable to undergo stress with nuclear MPI or echocardiography (de Azevedo et al., 2011). (Level of Evidence: C)

Class IIb

1. For patients with a low to intermediate pretest probability of obstructive IHD, noncontrast cardiac computed tomography (CT) to determine the coronary artery calcium (CAC) score may be considered (Sarwar et al., 2009). (Level of Evidence: C)

Risk Assessment

Advanced Testing: Resting and Stress Noninvasive Testing

Resting Imaging to Assess Cardiac Structure and Function

Class I

1. Assessment of resting left ventricular (LV) systolic and diastolic ventricular function and evaluation for abnormalities of myocardium, heart valves, or pericardium are recommended with the use of Doppler echocardiography in patients with known or suspected IHD and a prior myocardial infarction (MI), pathological Q waves, symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or an undiagnosed heart murmur (Hunt et al., 2009; Daly et al., 2006; Daly et al., 2003; Mock et al., 1982; Vitarelli et al., 2003). (Level of Evidence: B)

Class IIb

1. Assessment of cardiac structure and function with resting echocardiography may be considered in patients with hypertension or diabetes mellitus and an abnormal ECG. (Level of Evidence: C)
2. Measurement of LV function with radionuclide imaging may be considered in patients with a prior MI or pathological Q waves, provided there is no need to evaluate symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or an undiagnosed heart murmur. (Level of Evidence: C)

Class III: No Benefit

1. Echocardiography, radionuclide imaging, CMR, and cardiac CT are not recommended for routine assessment of LV function in patients with a normal ECG, no history of MI, no symptoms or signs suggestive of heart failure, and no complex ventricular arrhythmias. (Level of Evidence: C)
2. Routine reassessment (<1 year) of LV function with technologies such as echocardiography radionuclide imaging, CMR, or cardiac CT is not recommended in patients with no change in clinical status and for whom no change in therapy is contemplated. (Level of Evidence: C)

Stress Testing and Advanced Imaging in Patients with Known SIHD Who Require Noninvasive Testing for Risk Assessment

See Table 12 in the original guideline document for a summary of recommendations from this section.

Risk Assessment in Patients Able to Exercise

Class I

1. Standard exercise ECG testing is recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG (Christian et al., 1994; Gibbons et al., 1990; Hachamovitch et al., 2004; Ladenheim et al., 1987; Mattera et al., 1998; Mowatt et al., 2004; Nallamothu et al., 1995; Sabharwal et al., 2007; Garber & Solomon, 1999; Kuntz et al., 1999; Lorenzoni et al., 2003). (Level of Evidence: B)
2. The addition of either nuclear MPI or echocardiography to standard exercise ECG testing is recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an *un*interpretable ECG not due to left bundle-branch block (LBBB) or ventricular pacing (Gibbons et al., 2003; Metz et al., 2007; Nagao et al., 2007; Leischik et al., 2007; Johansen et al., 2006; Wagdy et al., 1998; McCully et al., 2002; Shaw et al., 2003). (Level of Evidence: B)

Class IIa

1. The addition of either nuclear MPI or echocardiography to standard exercise ECG testing is reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG (Bouzas-Mosquera et al., 2009; Navare et al., 2004; Gebker et al., 2011; Peteiro et al., 2010; Yao et al., 2012; Shaw et al., 2012; Hachamovitch et al., 2011; Doesch et al., 2009; Jahnke et al., 2007). (Level of Evidence: B)
2. CMR with pharmacological stress is reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an *un*interpretable ECG (Jahnke et al., 2007; Bingham & Hachamovitch, 2011; Coelho-Filho et al., 2011; Kelle et al., 2011; Korosoglou et al., 2010; Steel et al., 2009). (Level of Evidence: B)

Class IIb

1. CCTA may be reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an *un*interpretable ECG (Chow et al., 2010; Min et al., 2011). (Level of Evidence: B)

Class III: No Benefit

1. Pharmacological stress imaging (nuclear MPI, echocardiography, or CMR) or CCTA is not recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG. (Level of Evidence: C)

Risk Assessment in Patients Unable to Exercise

Class I

1. Pharmacological stress with either nuclear MPI or echocardiography is recommended for risk assessment in patients with SIHD who are unable to exercise to an adequate workload regardless of interpretability of ECG (Gibbons et al., 2003; Nagao et al., 2007; Leischik et al., 2007; Johansen et al., 2006; America et al., 2007; Gil et al., 1998; Nallamothu et al., 1997; Nigam & Humen, 1998). (Level of Evidence: B)

Class IIa

1. Pharmacological stress CMR is reasonable for risk assessment in patients with SIHD who are unable to exercise to an adequate workload regardless of interpretability of ECG (Bingham & Hachamovitch, 2011; Coelho-Filho et al., 2011; Kelle et al., 2011; Korosoglou et al., 2010; Steel et al., 2009; Pilz et al., 2008). (Level of Evidence: B)
2. CCTA can be useful as a first-line test for risk assessment in patients with SIHD who are unable to exercise to an adequate workload regardless of interpretability of ECG (Min et al., 2011). (Level of Evidence: C)

Risk Assessment Regardless of Patients' Ability to Exercise

Class I

1. Pharmacological stress with either nuclear MPI or echocardiography is recommended for risk assessment in patients with SIHD who have LBBB on ECG, regardless of ability to exercise to an adequate workload (America et al., 2007; Gil et al., 1998; Nallamothu et al., 1997; Nigam & Humen, 1998; Tandogan et al., 2001). (Level of Evidence: B)
2. Either exercise or pharmacological stress with imaging (nuclear MPI, echocardiography, or CMR) is recommended for risk assessment in patients with SIHD who are being considered for revascularization of known coronary stenosis of unclear physiological significance (Johansen et al., 2006; Doesch et al., 2009; Hacker et al., 2007; Yao, Bangalore, & Chaudhry, 2010). (Level of Evidence: B)

Class IIa

1. CCTA can be useful for risk assessment in patients with SIHD who have an indeterminate result from functional testing (Min et al., 2011). (Level of Evidence: C)

Class IIb

1. CCTA might be considered for risk assessment in patients with SIHD unable to undergo stress imaging or as an alternative to invasive coronary angiography when functional testing indicates a moderate- to high-risk result and knowledge of angiographic coronary anatomy is unknown. (Level of Evidence: C)

Class III: No Benefit

1. A request to perform either a) more than one stress imaging study or b) a stress imaging study and a CCTA at the same time is not recommended for risk assessment in patients with SIHD. (Level of Evidence: C)

Coronary Angiography

Coronary Angiography as an Initial Testing Strategy to Assess Risk

Class I

1. Patients with SIHD who have survived sudden cardiac death or potentially life-threatening ventricular arrhythmia should undergo coronary angiography to

assess cardiac risk ("Survivors," 1997; Every et al., 1992; Spaulding et al., 1997). (Level of Evidence: B)
2. Patients with SIHD who develop symptoms and signs of heart failure should be evaluated to determine whether coronary angiography should be performed for risk assessment (Califf et al., 1989; Myers et al., 1989; Myers et al., 1987; Bonow et al., 2011). (Level of Evidence: B)

Coronary Angiography to Assess Risk After Initial Workup with Noninvasive Testing

Class I

1. Coronary arteriography is recommended for patients with SIHD whose clinical characteristics and results of noninvasive testing indicate a high likelihood of severe IHD and when the benefits are deemed to exceed risk (Hammermeister, DeRouen, & Dodge, 1979; Mark et al., 1987; Mock et al., 1982; Hachamovitch et al., 1998; Brunelli, Cristofani, & L'Abbate, 1989; Chuah et al., 1998; Harris et al., 1979; Ladenheim et al., 1986; Marwick et al., 1997; Morrow et al., 1993; Stratmann et al., 1994). (Level of Evidence: C)

Class IIa

1. Coronary angiography is reasonable to further assess risk in patients with SIHD who have depressed LV function (ejection fraction [EF] <50%) and moderate risk criteria on noninvasive testing with demonstrable ischemia (Miller et al., 1994; Emond et al., 1994; Alderman et al., 1983). (Level of Evidence: C)
2. Coronary angiography is reasonable to further assess risk in patients with SIHD and inconclusive prognostic information after noninvasive testing or in patients for whom noninvasive testing is contraindicated or inadequate. (Level of Evidence: C)
3. Coronary angiography for risk assessment is reasonable for patients with SIHD who have unsatisfactory quality of life due to angina, have preserved LV function (EF >50%), and have intermediate risk criteria on noninvasive testing (Shaw et al., 2008; Boden et al., 2007). (Level of Evidence: C)

Class III: No Benefit

1. Coronary angiography for risk assessment is not recommended in patients with SIHD who elect not to undergo revascularization or who are not candidates for revascularization because of comorbidities or individual preferences (Shaw et al., 2008; Boden et al., 2007). (Level of Evidence: B)
2. Coronary angiography is not recommended to further assess risk in patients with SIHD who have preserved LV function (EF >50%) and low-risk criteria on noninvasive testing (Shaw et al., 2008; Boden et al., 2007). (Level of Evidence: B)
3. Coronary angiography is not recommended to assess risk in patients who are at low risk according to clinical criteria and who have not undergone noninvasive risk testing. (Level of Evidence: C)
4. Coronary angiography is not recommended to assess risk in asymptomatic patients with no evidence of ischemia on noninvasive testing. (Level of Evidence: C)

Treatment

Patient Education

Class I

1. Patients with SIHD should have an individualized education plan to optimize care and promote wellness, including:
    a. Education on the importance of medication adherence for managing symptoms and retarding disease progression (McGillion et al., 2007; Muszbek et al., 2008; Rao et al., 2004) (Level of Evidence: C)
    b. An explanation of medication management and cardiovascular risk reduction strategies in a manner that respects the patient's level of understanding, reading comprehension, and ethnicity (Smith et al., 2011; Mosca et al., 2011; Joint Commission, 2007; Miller & Taylor, 1995; DeBusk et al., 1994; Haskell et al., 1994;) (Level of Evidence: B)
    c. A comprehensive review of all therapeutic options (Smith et al., 2011; Joint Commission, 2007; Miller & Taylor, 1995; DeBusk et al., 1994; Haskell et al., 1994) (Level of Evidence: B)
    d. A description of appropriate levels of exercise, with encouragement to maintain recommended levels of daily physical activity (Smith et al., 2011; American Heart Association Nutrition Committee et al., 2006; Thompson et al., 2003; Thompson et al., 2007; Artinian et al., 2010) (Level of Evidence: C)
    e. Introduction to self-monitoring skills (American Heart Association Nutrition Committee et al., 2006; Thompson et al., 2007; Artinian et al., 2010) (Level of Evidence: C)
    f. Information on how to recognize worsening cardiovascular symptoms and take appropriate action. (Level of Evidence: C)
2. Patients with SIHD should be educated about the following lifestyle elements that could influence prognosis: weight control, maintenance of a body mass index (BMI) of 18.5 to 24.9 kg/m^2, and maintenance of a waist circumference less than 102 cm (40 inches) in men and less than 88 cm (35 inches) in women (less for certain racial groups) (Smith et al., 2011; Mosca et al., 2011; National Heart Lung and Blood Institute [NHLBI], 1998; Oka et al., 2008; Tan et al., 2004; Buse et al., 2007); lipid management ("Third Report," 2002); blood pressure (BP) control (Chobanian et al., 2003; Bosworth et al., 2007); smoking cessation and avoidance of exposure to secondhand smoke (Smith et al., 2011; "The 2004 United States Surgeon General's Report," 2004; Critchley & Capewell, "Mortality," 2003); and individualized medical, nutrition, and lifestyle changes for patients with diabetes mellitus to supplement diabetes treatment goals and education (American Diabetes Association, 2011). (Level of Evidence: C)

Class IIa

1. It is reasonable to educate patients with SIHD about:

a. Adherence to a diet that is low in saturated fat, cholesterol, and trans fat; high in fresh fruits, whole grains, and vegetables; and reduced in sodium intake, with cultural and ethnic preferences incorporated (Smith et al., 2011; Chobanian et al., 2003; "Third Report," 2002; Appel et al., 2003; Cholesterol Treatment Trialists' [CTT] Collaboration et al., 2010) (Level of Evidence: B)
b. Common symptoms of stress and depression to minimize stress-related angina symptoms (Frattaroli et al., 2008) (Level of Evidence: C)
c. Comprehensive behavioral approaches for the management of stress and depression (Berkman et al., 2003; Carney et al., 1995; Rees et al., 2004; Ziegelstein et al., 2000) (Level of Evidence: C)
d. Evaluation and treatment of major depressive disorder when indicated (Berkman et al., 2003; Glassman et al., 2002; McGillion et al., 2007; Rees et al., 2004; Lesperance et al., 2007; McManus, Pipkin, & Whooley, 2005; Whooley, 2006; Lichtman et al., 2008). (Level of Evidence: B)

Guideline-Directed Medical Therapy (GDMT)

Risk Factor Modification

Lipid Management

Class I

1. Lifestyle modifications, including daily physical activity and weight management, are strongly recommended for all patients with SIHD ("Third Report," 2002; Dattilo & Kris-Etherton, 1992). (Level of Evidence: B)
2. Dietary therapy for all patients should include reduced intake of saturated fats (to <7% of total calories), trans fatty acids (to <1% of total calories), and cholesterol (to <200 mg/d) ("Third Report," 2002; Ginsberg et al., 1998; Schaefer et al., 1997; Schaefer et al., 1995; Yu-Poth et al., 1999). (Level of Evidence: B)
3. In addition to therapeutic lifestyle changes, a moderate or high dose of a statin therapy should be prescribed, in the absence of contraindications or documented adverse effects ("Third Report," 2002; Heart Protection Study Collaborative Group, 2002; LaRosa et al., 2005; CTT Collaboration et al., 2010; Pedersen et al., 2005). (Level of Evidence: A)

Class IIa

1. For patients who do not tolerate statins, low-density lipoprotein (LDL) cholesterol–lowering therapy with bile acid sequestrants,* niacin,† or both is reasonable ("The Lipid Research Clinics," 1984; Canner et al., 1986; Brown et al., 2001). (Level of Evidence: B)

*The use of bile acid sequestrant is relatively contraindicated when triglycerides are ≥200 mg/dL and is contraindicated when triglycerides are ≥500 mg/dL.

†Dietary supplement niacin must not be used as a substitute for prescription niacin.

Blood Pressure Management

Class I

1. All patients should be counseled about the need for lifestyle modification: weight control; increased physical activity; alcohol moderation; sodium reduction; and emphasis on increased consumption of fresh fruits, vegetables, and low-fat dairy products (Chobanian et al., 2003; "Effects of weight loss," 1997; Stevens et al., 1993; Whelton et al., 1998; Appel et al., 1997; Sacks et al., 2001; MacGregor et al., 1989; Whelton et al., 2002; Xin et al., 2001; Appel et al., 2011). (Level of Evidence: B)
2. In patients with SIHD with BP 140/90 mm Hg or higher, antihypertensive drug therapy should be instituted in addition to or after a trial of lifestyle modifications ("Medical Research Council," 1992; SHEP Cooperative Research Group, 1991; "MRC trial of treatment," 1985; "Effect of stepped care," 1984; "The effect of treatment," 1982; "Five-year findings," 1979). (Level of Evidence: A)
3. The specific medications used for treatment of high BP should be based on specific patient characteristics and may include angiotensin-converting enzyme (ACE) inhibitors and/or beta blockers, with addition of other drugs, such as thiazide diuretics or calcium channel blockers, if needed to achieve a goal BP of less than 140/90 mm Hg ("Major outcomes," 2002; Turnbull, 2003). (Level of Evidence: B)

Diabetes Management

Class IIa

1. For selected individual patients, such as those with a short duration of diabetes mellitus and a long life expectancy, a goal hemoglobin A1c (HbA1c) of 7% or less is reasonable (Diabetes Control and Complications Trial Research Group, 1993; U.K. Prospective Diabetes Study [UKPDS] Group, 1998; ADVANCE Collaborative Group et al., 2008). (Level of Evidence: B)
2. A goal HbA1c between 7% and 9% is reasonable for certain patients according to age, history of hypoglycemia, presence of microvascular or macrovascular complications, or presence of coexisting medical conditions (Dluhy & McMahon, 2008; Duckworth et al., 2009). (Level of Evidence: C)

Class IIb

1. Initiation of pharmacotherapy interventions to achieve target HbA1c might be reasonable (American Diabetes Association, 2011; Nathan et al., 2005; "Effect of intensive," 1998; Dormandy et al., 2005; Skyler et al., 2009; Kelly et al., 2009; Selvin et al., 2008; Turnbull et al., 2009; Ray et al., 2009; Currie et al., 2010; Holman et al., 2008). (Level of Evidence: A)

Class III: Harm

1. Therapy with rosiglitazone should not be initiated in patients with SIHD (Loke, Kwok, & Singh, 2011; Woodcock, 2010). (Level of Evidence: C)

Physical Activity

Class I

1. For all patients, the clinician should encourage 30 to 60 minutes of moderate-intensity aerobic activity, such as brisk walking, at least 5 days and preferably 7 days per week, supplemented by an increase in daily lifestyle activities (e.g., walking breaks at work, gardening, household work) to improve cardiorespiratory fitness and move patients out of the least-fit, least-active, high-risk cohort (bottom 20%) (Taylor et al., 2004; Haskell et al., 2007; U.S. Department of Health and Human Services, 2008). (Level of Evidence: B)
2. For all patients, risk assessment with a physical activity history and/or an exercise test is recommended to guide prognosis and prescription (Ken-Dror et al., 2004; Cardinal, 1996; Nowak et al., 2010; Jurca et al., 2005). (Level of Evidence: B)
3. Medically supervised programs (cardiac rehabilitation) and physician-directed, home-based programs are recommended for at-risk patients at first diagnosis (Taylor et al., 2004; Taylor et al., 2010; Clark et al., 2010). (Level of Evidence: A)

Class IIa

1. It is reasonable for the clinician to recommend complementary resistance training at least 2 days per week (McCartney et al., 1991; Beniamini et al., 1999). (Level of Evidence: C)

Weight Management

Class I

1. BMI and/or waist circumference should be assessed at every visit, and the clinician should consistently encourage weight maintenance or reduction through an appropriate balance of lifestyle physical activity, structured exercise, caloric intake, and formal behavioral programs when indicated to maintain or achieve a BMI between 18.5 and 24.9 kg/m^2 and a waist circumference less than 102 cm (40 inches) in men and less than 88 cm (35 inches) in women (less for certain racial groups) (Grundy et al., 2005; NHLBI, 1998; Bogers et al., 2007; Klein et al., 2004; Calle et al., 1999; Jensen et al., 2008; Arnlov et al., 2010; Lavie, Milani & Ventura, 2009; Gruberg et al., 2002; Jacobs et al., 2010). (Level of Evidence: B)
2. The initial goal of weight loss therapy should be to reduce body weight by approximately 5% to 10% from baseline. With success, further weight loss can be attempted if indicated. (Level of Evidence: C)

Smoking Cessation Counseling

Class I

1. Smoking cessation and avoidance of exposure to environmental tobacco smoke at work and home should be encouraged for all patients with SIHD. Follow-up, referral to special programs, and pharmacotherapy are recommended, as is a stepwise strategy for smoking cessation (Ask, Advise, Assess, Assist, Arrange, Avoid) (Critchley & Capewell, "Smoking," 2003; Rigotti, 2009; Smith & Burgess, 2009). (Level of Evidence: B)

Management of Psychological Factors

Class IIa

1. It is reasonable to consider screening SIHD patients for depression and to refer or treat when indicated (Berkman et al., 2003; Ruo et al., 2003; Yoshinaga et al., 2006; Appel et al., 2003; Lesperance et al., 2007; Honig et al., 2007; DiMatteo, Lepper, & Croghan, 2000). (Level of Evidence: B)

Class IIb

1. Treatment of depression has not been shown to improve cardiovascular disease outcomes but might be reasonable for its other clinical benefits (Berkman et al., 2003; Glassman et al., 2002; Taylor et al., 2005). (Level of Evidence: C)

Alcohol Consumption

Class IIb

1. In patients with SIHD who use alcohol, it might be reasonable for nonpregnant women to have 1 drink (4 ounces of wine, 12 ounces of beer, or 1 ounce of spirits) a day and for men to have 1 or 2 drinks a day, unless alcohol is contraindicated (such as in patients with a history of alcohol abuse or dependence or with liver disease) (Di Castelnuovo et al., 2002; Mukamal et al., 2001; Muntwyler et al., 1998). (Level of Evidence: C)

Avoiding Exposure to Air Pollution

Class IIa

1. It is reasonable for patients with SIHD to avoid exposure to increased air pollution to reduce the risk of cardiovascular events (Pope et al., 2004; Pope et al., 2006; Pope, 2007; Brook et al., 2010). (Level of Evidence: C)

Additional Medical Therapy to Prevent MI and Death

Antiplatelet Therapy

Class I

1. Treatment with aspirin 75 to 162 mg daily should be continued indefinitely in the absence of contraindications in patients with SIHD (Antithrombotic Trialists' Collaboration, 2002; Juul-Moller et al., 1992). (Level of Evidence: A)
2. Treatment with clopidogrel is reasonable when aspirin is contraindicated in patients with SIHD (CAPRIE Steering Committee, 1996). (Level of Evidence: B)

Class IIb

1. Treatment with aspirin 75 to 162 mg daily and clopidogrel 75 mg daily might be reasonable in certain high-risk patients with SIHD (Bhatt et al., 2007). (Level of Evidence: B)

Class III: No Benefit

1. Dipyridamole is not recommended as antiplatelet therapy for patients with SIHD (Hirsh et al., 1995; Balsano et al., 1990; "The Persantine-aspirin reinfarction study," 1980). (Level of Evidence: B)

Beta-Blocker Therapy

Class I

1. Beta-blocker therapy should be started and continued for 3 years in all patients with normal LV function after MI or acute coronary syndrome (ACS) (Kernis et al., 2004; de Peuter et al., 2009; Freemantle et al., 1999). (Level of Evidence: B)
2. Beta-blocker therapy should be used in all patients with LV systolic dysfunction (EF ≤40%) with heart failure or prior MI, unless contraindicated. (Use should be limited to carvedilol, metoprolol succinate, or bisoprolol, which have been shown to reduce risk of death.) (Tepper, 1999; Packer et al., 1996; Leizorovicz et al., 2002; Poole-Wilson et al., 2003; Domanski et al., 2003) (Level of Evidence: A)

Class IIb

1. Beta blockers may be considered as chronic therapy for all other patients with coronary or other vascular disease. (Level of Evidence: C)

Renin-Angiotensin-Aldosterone Blocker Therapy

Class I

1. ACE inhibitors should be prescribed in all patients with SIHD who also have hypertension, diabetes mellitus, left ventricular ejection fraction (LVEF) 40% or less, or chronic kidney disease (CKD), unless contraindicated (Braunwald et al., 2004; Fox, 2003; Garg & Yusuf, 1995; Kunz et al., 2008; Yusuf et al., "Effects," 2000). (Level of Evidence: A)
2. Angiotensin-receptor blockers (ARBs) are recommended for patients with SIHD who have hypertension, diabetes mellitus, LV systolic dysfunction, or CKD and have indications for, but are intolerant of, ACE inhibitors (McMurray et al., 2003; Nissen et al., 2004; Julius et al., 2006). (Level of Evidence: A)

Class IIa

1. Treatment with an ACE inhibitor is reasonable in patients with both SIHD and other vascular disease (Danchin et al., 2006; Al-Mallah et al., 2006). (Level of Evidence: B)
2. It is reasonable to use ARBs in other patients who are ACE inhibitor intolerant (Pitt et al., 2001). (Level of Evidence: C) (see Table 15 in the original guideline document.)

Influenza Vaccination

Class I

1. An annual influenza vaccine is recommended for patients with SIHD ("H5N1 avian influenza," 2005; Davis et al., 2006; de Diego et al., 2009; Couch et al., 2007; Keitel et al., 2006). (Level of Evidence: B)

Additional Therapy to Reduce Risk of MI and Death

Class III: No Benefit

1. Estrogen therapy is not recommended in postmenopausal women with SIHD with the intent of reducing cardiovascular risk or improving clinical outcomes (Hulley et al., 1998; Anderson et al., 2004; Manson et al., 2003; Rossouw et al., 2002). (Level of Evidence: A)
2. Vitamin C, vitamin E, and beta-carotene supplementation are not recommended with the intent of reducing cardiovascular risk or improving clinical outcomes in patients with SIHD (Heart Protection Study Collaborative Group, 2002; "Dietary supplementation," 1999; de Gaetano, 2001; Stephens et al., 1996; Yusuf et al., "Vitamin E," 2000; Bjelakovic et al., 2007). (Level of Evidence: A)
3. Treatment of elevated homocysteine with folate or vitamins B6 and B12 is not recommended with the intent of reducing cardiovascular risk or improving clinical outcomes in patients with SIHD (Bazzano et al., 2006; Bonaa et al., 2006; Lonn et al., 2006; Toole et al., 2004). (Level of Evidence: A)
4. Chelation therapy is not recommended with the intent of improving symptoms or reducing cardiovascular risk in patients with SIHD (Guldager et al., 1992;

van Rij et al., 1994; Sloth-Nielsen et al., 1991; Knudtson et al., 2002). (Level of Evidence: C)

5. Treatment with garlic, coenzyme Q10, selenium, or chromium is not recommended with the intent of reducing cardiovascular risk or improving clinical outcomes in patients with SIHD. (Level of Evidence: C)

Medical Therapy for Relief of Symptoms

Use of Anti-ischemic Medications

Class I

1. Beta blockers should be prescribed as initial therapy for relief of symptoms in patients with SIHD (Kernis et al., 2004; Frishman et al., 1991; Narahara, 1990). (Level of Evidence: B)
2. Calcium channel blockers or long-acting nitrates should be prescribed for relief of symptoms when beta blockers are contraindicated or cause unacceptable side effects in patients with SIHD (Heidenreich et al., 1999; Ryden, 1992; Boberg, Larsen, & Pehrsson, 1992). (Level of Evidence: B)
3. Calcium channel blockers or long-acting nitrates, in combination with beta blockers, should be prescribed for relief of symptoms when initial treatment with beta blockers is unsuccessful in patients with SIHD (Heidenreich et al., 1999). (Level of Evidence: B)
4. Sublingual nitroglycerin or nitroglycerin spray is recommended for immediate relief of angina in patients with SIHD (Abrams, 2005; Wight et al., 1992; VandenBurg et al., 1986). (Level of Evidence: B)

Class IIa

1. Treatment with a long-acting nondihydropyridine calcium channel blocker (verapamil or diltiazem) instead of a beta blocker as initial therapy for relief of symptoms is reasonable in patients with SIHD (Heidenreich et al., 1999). (Level of Evidence: B)
2. Ranolazine can be useful when prescribed as a substitute for beta blockers for relief of symptoms in patients with SIHD if initial treatment with beta blockers leads to unacceptable side effects or is ineffective or if initial treatment with beta blockers is contraindicated (Rousseau et al., 2005). (Level of Evidence: B)
3. Ranolazine in combination with beta blockers can be useful when prescribed for relief of symptoms when initial treatment with beta blockers is not successful in patients with SIHD (Chaitman et al., 2004; Stone et al., 2006). (Level of Evidence: A)

Alternative Therapies for Relief of Symptoms in Patients with Refractory Angina

Class IIb

1. Enhanced external counterpulsation (EECP) may be considered for relief of refractory angina in patients with SIHD (Arora et al., 1999). (Level of Evidence: B)
2. Spinal cord stimulation may be considered for relief of refractory angina in patients with SIHD (Mannheimer et al., 1998; Hautvast et al., 1998). (Level of Evidence: C)
3. Transmyocardial revascularization (TMR) may be considered for relief of refractory angina in patients with SIHD (van der Sloot et al., 2004; Guleserian et al., 2003; Myers et al., 2002). (Level of Evidence: B)

Class III: No Benefit

1. Acupuncture should not be used for the purpose of improving symptoms or reducing cardiovascular risk in patients with SIHD (Ballegaard et al., 1990; Ballegaard et al., 1986). (Level of Evidence: C)

Coronary Artery Disease (CAD) Revascularization

Heart Team Approach to Revascularization Decisions

Class I

1. A Heart Team approach to revascularization is recommended in patients with unprotected left main or complex CAD (Serruys et al., 2009; Feit et al., 2000; King et al., 1997). (Level of Evidence: C)

Class IIa

1. Calculation of the Society of Thoracic Surgeons (STS) and Synergy between Percutaneous Coronary Intervention with TAXUS and Cardiac Surgery (SYNTAX) scores is reasonable in patients with unprotected left main and complex CAD (Morice et al., 2010; Serruys et al., 2009; Chakravarty et al., 2011; Grover et al., 2001; Kim et al., 2010; Shahian et al., 2009; Shahian et al., 2010). (Level of Evidence: B)

Revascularization to Improve Survival

Left Main CAD Revascularization

Class I

1. Coronary artery bypass graft (CABG) to improve survival is recommended for patients with significant (≥50% diameter stenosis) left main coronary artery stenosis (Chaitman et al., 1981; Caracciolo et al., 1995; Yusuf et al., 1994; Dzavik et al., 2001; Takaro et al., 1976; Takaro et al., 1982; Taylor et al., 1989). (Level of Evidence: B)

Class IIa

1. Percutaneous coronary intervention (PCI) to improve survival is reasonable as an alternative to CABG in selected stable patients with significant (≥50% diameter stenosis) unprotected left main CAD with: 1) anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (e.g., a low SYNTAX score [≤22], ostial or trunk left main CAD); *and* 2) clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (e.g., STS-predicted risk of operative mortality ≥5%) (Morice et al., 2010; Chakravarty et al., 2011; Kim et al., 2010; Buszman et al., 2008; Capodanno et al., 2011; Hannan et al., 2008; Ellis et al., 1997; Biondi-Zoccai et al., 2008; Boudriot et al., 2011; Brener et al., 2008; Chieffo et al., 2010; Chieffo et al., 2006; Lee et al., 2006; Makikallio et al., 2008; Naik et al., 2009; Palmerini et al., 2006; Park et al., 2010; Rodes-Cabau et al., 2008; Sanmartin et al., 2007; Seung et al., 2008; White et al., 2008). (Level of Evidence: B)
2. PCI to improve survival is reasonable in patients with unstable angina/non–ST-elevation myocardial infarction (UA/NSTEMI) when an unprotected left main coronary artery is the culprit lesion and the patient is not a candidate for CABG (Morice et al., 2010; Brener et al., 2008; Chieffo et al., 2010; Chieffo et al., 2006; Lee et al., 2006; Rodes-Cabau et al., 2008; Sanmartin et al., 2007; Seung et al., 2008; White et al., 2008; Montalescot et al., 2009). (Level of Evidence: B)
3. PCI to improve survival is reasonable in patients with acute ST-elevation myocardial infarction (STEMI) when an unprotected left main coronary artery is the culprit lesion, distal coronary flow is less than TIMI (Thrombolysis In Myocardial Infarction) grade 3, and PCI can be performed more rapidly and safely than CABG (Ellis et al., 1997; Lee et al., 2008; Lee et al., 2010). (Level of Evidence: C)

Class IIb

1. PCI to improve survival may be reasonable as an alternative to CABG in selected stable patients with significant (≥50% diameter stenosis) unprotected left main CAD with: a) anatomic conditions associated with a low to intermediate risk of PCI procedural complications and an intermediate to high likelihood of good long-term outcome (e.g., low–intermediate SYNTAX score of <33, bifurcation left main CAD); *and* b) clinical characteristics that predict an increased risk of adverse surgical outcomes (e.g., moderate–severe chronic obstructive pulmonary disease, disability from previous stroke, or previous cardiac surgery; STS-predicted risk of operative mortality <2%) (Morice et al., 2010; Chakravarty et al., 2011; Kim et al., 2010; Buszman et al., 2008; Capodanno et al., 2011; Hannan et al., 2008; Ellis et al., 1997; Biondi-Zoccai et al., 2008; Boudriot et al., 2011; Brener et al., 2008; Chieffo et al., 2010; Chieffo et al., 2006; Lee et al., 2006; Makikallio et al., 2008; Naik et al., 2009; Palmerini et al., 2006; Park et al., 2010; Rodes-Cabau et al., 2008; Sanmartin et al., 2007; Seung et al., 2008; White et al., 2008; Park et al., 2011). (Level of Evidence: B)

Class III: Harm

1. PCI to improve survival should not be performed in stable patients with significant (≥50% diameter stenosis) unprotected left main CAD who have unfavorable anatomy for PCI and who are good candidates for CABG (Chaitman et al., 1981; Caracciolo et al., 1995; Yusuf et al., 1994; Morice et al., 2010; Chakravarty et al., 2011; Kim et al., 2010; Dzavik et al., 2001; Takaro et al., 1976; Takaro et al., 1982; Taylor et al., 1989; Capodanno et al., 2011; Hannan et al., 2008). (Level of Evidence: B)

Non–Left Main CAD Revascularization

Class I

1. CABG to improve survival is beneficial in patients with significant (≥70% diameter) stenoses in three major coronary arteries (with or without involvement of the proximal left anterior descending [LAD] artery) or in the proximal LAD artery plus one other major coronary artery (Myers et al., 1989; Yusuf et al., 1994; Dzavik et al., 2001; Jones et al., 1996; Varnauskas, 1988; Smith et al., 2006). (Level of Evidence: B)
2. CABG or PCI to improve survival is beneficial in survivors of sudden cardiac death with presumed ischemia-mediated ventricular tachycardia caused by significant (≥70% diameter) stenosis in a major coronary artery. (CABG Level of Evidence: B [Every et al., 1992; Borger van der Burg et al., 2003; Kaiser et al., 1975]; PCI Level of Evidence: C [Borger van der Burg et al., 2003])

Class IIa

1. CABG to improve survival is reasonable in patients with significant (≥70% diameter) stenoses in two major coronary arteries with severe or extensive myocardial ischemia (e.g., high-risk criteria on stress testing, abnormal intracoronary hemodynamic evaluation, or >20% perfusion defect by myocardial perfusion stress imaging) or target vessels supplying a large area of viable myocardium (Hachamovitch et al., 2003; Di Carli et al., 1998; Sorajja et al., 2005; Davies et al., 1997). (Level of Evidence: B)
2. CABG to improve survival is reasonable in patients with mild–moderate LV systolic dysfunction (EF 35% to 50%) and significant (≥70% diameter stenosis) multivessel CAD or proximal LAD coronary artery stenosis, when viable myocardium is present in the region of intended revascularization (Alderman et al., 1983; Yusuf et al., 1994; O'Connor et al., 2002; Phillips, O'Connor, & Rogers, 2007; Tarakji et al., 2006; Tsuyuki et al., 2006). (Level of Evidence: B)
3. CABG with a left internal mammary artery (LIMA) graft to improve survival is reasonable in patients with significant (≥70% diameter) stenosis in the proximal LAD artery and evidence of extensive ischemia (Yusuf et al., 1994; Smith et al., 2006; Cameron et al., 1996; Loop et al., 1986). (Level of Evidence: B)
4. It is reasonable to choose CABG over PCI to improve survival in patients with complex 3-vessel CAD (e.g., SYNTAX score >22), with or without involvement of the proximal LAD artery who are good candidates for CABG (Hannan et al., 2008; Kappetein et al., 2011; Smith et al., 2006; Brener et al., 2004; Hannan et al., 2005). (Level of Evidence: B)
5. CABG is probably recommended in preference to PCI to improve survival in patients with multivessel CAD and diabetes mellitus, particularly if a LIMA graft can be anastomosed to the LAD artery (Sorajja et al., 2005; "Influence of diabetes," 1997; Banning et al., 2010; Hoffman et al., 2003; Hueb et al., 2007; Malenka et al., 2005; Niles et al., 2001; Weintraub et al., 1998). (Level of Evidence: B)

Class IIb

1. The usefulness of CABG to improve survival is uncertain in patients with significant (70%) diameter stenoses in two major coronary arteries not involving the proximal LAD artery and without extensive ischemia (Smith et al., 2006). (Level of Evidence: C)
2. The usefulness of PCI to improve survival is uncertain in patients with 2- or 3-vessel CAD (with or without involvement of the proximal LAD artery) or 1-vessel proximal LAD disease (Boden et al., 2007; Dzavik et al., 2001; Jones et al., 1996; Smith et al., 2006). (Level of Evidence: B)
3. CABG might be considered with the primary or sole intent of improving survival in patients with SIHD with severe LV systolic dysfunction (EF <35%) whether or not viable myocardium is present (Bonow et al., 2011; Alderman et al., 1983; Velazquez et al., 2011; Yusuf et al., 1994; O'Connor et al., 2002; Phillips, O'Connor, & Rogers, 2007; Tarakji et al., 2006; Tsuyuki et al., 2006). (Level of Evidence: B)
4. The usefulness of CABG or PCI to improve survival is uncertain in patients with previous CABG and extensive anterior wall ischemia on noninvasive testing (Gurfinkel et al., 2007; Morrison et al., 2001; Subramanian et al., 2009; Pfautsch et al., 1999; Weintraub et al., 1997; Brener et al., 2006; Lytle et al., 1993; Sergeant et al., 1998; Stephan et al., 1996). (Level of Evidence: B)

Class III: Harm

1. CABG or PCI should not be performed with the primary or sole intent to improve survival in patients with SIHD with one or more coronary stenoses that are not anatomically or functionally significant (e.g., <70% diameter non–left main coronary artery stenosis, fractional flow reserve [FFR] >0.80, no or only mild ischemia on noninvasive testing), involve only the left circumflex or right coronary artery, or subtend only a small area of viable myocardium (Shaw et al., 2008; Hachamovitch et al., 2003; Yusuf et al., 1994; Jones et al., 1996; Di Carli et al., 1998; Cashin et al., 1984; Pijls et al., 1996; Tonino et al., 2009; Sawada et al., 2003). (Level of Evidence: B)

Revascularization to Improve Symptoms

Class I

1. CABG or PCI to improve symptoms is beneficial in patients with one or more significant (≥70% diameter) coronary artery stenoses amenable to revascularization and unacceptable angina despite GDMT (Boden et al., 2007; Weintraub et al., 2008; Benzer, Hofer, & Oldridge, 2003; Bonaros et al., 2005; Bucher et al., 2000; Favarato et al., 2007; Hueb et al., 2010; Pocock et al., 1996; Pocock et al., 2000; Wijeysundera et al., 2010; Abizaid et al., 2001). (Level of Evidence: A)

Class IIa

1. CABG or PCI to improve symptoms is reasonable in patients with one or more significant (≥70% diameter) coronary artery stenoses and unacceptable angina for whom GDMT cannot be implemented because of medication contraindications, adverse effects, or patient preferences. (Level of Evidence: C)
2. PCI to improve symptoms is reasonable in patients with previous CABG, one or more significant (≥70% diameter) coronary artery stenoses associated with ischemia, and unacceptable angina despite GDMT (Gurfinkel et al., 2007; Subramanian et al., 2009; Pfautsch et al., 1999). (Level of Evidence: C)
3. It is reasonable to choose CABG over PCI to improve symptoms in patients with complex 3-vessel CAD (e.g., SYNTAX score >22), with or without involvement of the proximal LAD artery, who are good candidates for CABG (Hannan et al., 2008; Kappetein et al., 2011; Smith et al., 2006; Brener et al., 2004; Hannan et al., 2005). (Level of Evidence: B)

Class IIb

1. CABG to improve symptoms might be reasonable for patients with previous CABG, one or more significant (≥70% diameter) coronary artery stenoses not amenable to PCI, and unacceptable angina despite GDMT (Weintraub et al., 1997). (Level of Evidence: C)
2. TMR performed as an adjunct to CABG to improve symptoms may be reasonable in patients with viable ischemic myocardium that is perfused by arteries that are not amenable to grafting (Aaberge et al., 2000; Burkhoff et al., 1999; Schofield et al., 1999; Allen et al., 2000; Stamou et al., 2002). (Level of Evidence: B)

Class III: Harm

1. CABG or PCI to improve symptoms should not be performed in patients who do not meet anatomic (≥50% diameter left main or ≥70% non–left main stenosis diameter) or physiological (e.g., abnormal FFR) criteria for revascularization. (Level of Evidence: C)

Clinical Factors That May Influence the Choice of Revascularization

Dual Antiplatelet Therapy (DAPT) Compliance and Stent Thrombosis

Class III: Harm

1. PCI with coronary stenting (bare-metal stent [BMS] or drug-eluting stent [DES]) should not be performed if the patient is not likely to be able to tolerate and comply with DAPT for the appropriate duration of treatment based on the type of stent implanted (Grines et al., 2007; Leon et al., 1998; Mauri et al., 2007; McFadden et al., 2004). (Level of Evidence: B)

Hybrid Coronary Revascularization

Class IIa

1. Hybrid coronary revascularization (defined as the planned combination of LIMA-to-LAD artery grafting and PCI of ≥1 non-LAD coronary arteries) is reasonable in patients with one or more of the following (Bonatti et al., 2008; Gilard et al., 2007; Holzhey et al., 2008; Kon et al., 2008; Reicher et al., 2008; Vassiliades et al., 2006; Zhao et al., 2009) (Level of Evidence: B):
    a. Limitations to traditional CABG, such as heavily calcified proximal aorta or poor target vessels for CABG (but amenable to PCI)
    b. Lack of suitable graft conduits
    c. Unfavorable LAD artery for PCI (i.e., excessive vessel tortuosity or chronic total occlusion)

Class IIb

1. Hybrid coronary revascularization (defined as the planned combination of LIMA-to-LAD artery grafting and PCI of ≥1 non-LAD coronary arteries) may be reasonable as an alternative to multivessel PCI or CABG in an attempt to improve the overall risk–benefit ratio of the procedures. (Level of Evidence: C)

Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

Clinical Evaluation, Echocardiography During Routine, Periodic Follow-Up

Class I

1. Patients with SIHD should receive periodic follow-up, at least annually, that includes all of the following (Level of Evidence: C):
    a. Assessment of symptoms and clinical function
    b. Surveillance for complications of SIHD, including heart failure and arrhythmias
    c. Monitoring of cardiac risk factors
    d. Assessment of the adequacy of and adherence to recommended lifestyle changes and medical therapy
2. Assessment of LVEF and segmental wall motion by echocardiography or radionuclide imaging is recommended in patients with new or worsening heart failure or evidence of intervening MI by history or ECG. (Level of Evidence: C)

Class IIb

1. Periodic screening for important comorbidities that are prevalent in patients with SIHD, including diabetes mellitus, depression, and CKD, might be reasonable. (Level of Evidence: C)
2. A resting 12-lead ECG at 1-year or longer intervals between studies in patients with stable symptoms might be reasonable. (Level of Evidence: C)

Class III: No Benefit

1. Measurement of LV function with a technology such as echocardiography or radionuclide imaging is not recommended for routine periodic reassessment of patients who have not had a change in clinical status or who are at low risk of adverse cardiovascular events (Hachamovitch et al., 2002). (Level of Evidence: C)

Noninvasive Testing in Known SIHD

Follow-Up Noninvasive Testing in Patients with Known SIHD: New, Recurrent, or Worsening Symptoms Not Consistent with Unstable Angina

See Table 20 in the original guideline document for a summary of recommendations from this section.

Patients Able To Exercise

Class I

1. Standard exercise ECG testing is recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who have a) at least moderate physical functioning and no disabling comorbidity and b) an interpretable ECG (Sabharwal et al., 2007; Gianrossi et al., 1989; Kwok et al., 1999; Shaw et al., 2011). (Level of Evidence: B)
2. Exercise with nuclear MPI or echocardiography is recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who have a) at least moderate physical functioning or no disabling comorbidity but b) an *un*interpretable ECG (Schwitter et al., 2008; Shaw et al., 2012; Doesch et al., 2009; Steel et al., 2009; Shaw et al., 2008; Shaw et al., 2000; Shaw et al., 2005; Hachamovitch et al., 2005; Yao et al., 2003; Hachamovitch et al., 2003; Gehi et al., 2008; Bodi et al., 2007; Sawada et al., 2007; Lauer et al., 1998; Calnon et al., 2001; Berman et al., 1995). (Level of Evidence: B)

Class IIa

1. Exercise with nuclear MPI or echocardiography is reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA and who have a) at least moderate physical functioning and no disabling comorbidity, b) previously required imaging with exercise stress, or c) known multivessel disease or high risk for multivessel disease (Chatziioannou et al., 1999; Peteiro et al., 2006). (Level of Evidence: B)

Class III: No Benefit

1. Pharmacological stress imaging with nuclear MPI, echocardiography, or CMR is not recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who are capable of at least moderate physical functioning or have no disabling comorbidity (Parisi,

Hartigan, & Folland, 1997). (Level of Evidence: C)

Patients Unable To Exercise

Class I

1. Pharmacological stress imaging with nuclear MPI or echocardiography is recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who are incapable of at least moderate physical functioning or have disabling comorbidity (Biagini et al., 2006; Geleijnse et al., 2007; Imran, Palinkas, & Picano, 2003; Marcassa et al., 2008; Nandalur et al., 2007; Picano, Molinaro, & Pasanisi, 2008; Underwood et al., "Myocardial perfusion scintigraphy and cost effectiveness," 2004; Underwood et al., "Myocardial perfusion scintigraphy: the evidence," 2004). (Level of Evidence: B)

Class IIa

1. Pharmacological stress imaging with CMR is reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA and who are incapable of at least moderate physical functioning or have disabling comorbidity (Bingham & Hachamovitch, 2011; Coelho-Filho et al., 2011; Korosoglou et al., 2010). (Level of Evidence: B)

Class III: No Benefit

1. Standard exercise ECG testing should not be performed in patients with known SIHD who have new or worsening symptoms not consistent with UA and who a) are incapable of at least moderate physical functioning or have disabling comorbidity or b) have an uninterpretable ECG. (Level of Evidence: C)

Irrespective of Ability to Exercise

Class IIb

1. CCTA for assessment of patency of CABG or of coronary stents 3 mm or larger in diameter might be reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise (Mowatt et al., 2008; Jones et al., 2007; Hamon et al., 2008; Carrabba et al., 2010; Sun & Almutairi, 2010). (Level of Evidence: B)
2. CCTA might be reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise, in the absence of known moderate or severe calcification or if the CCTA is intended to assess coronary stents less than 3 mm in diameter (Schuetz et al., 2010; Janne d'Othee et al., 2008; Mowatt et al., 2008). (Level of Evidence: B)

Class III: No Benefit

1. CCTA should not be performed for assessment of native coronary arteries with known moderate or severe calcification or with coronary stents less than 3 mm in diameter in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise (Mowatt et al., 2008; Jones et al., 2007; Hamon et al., 2008; Carrabba et al., 2010; Sun & Almutairi, 2010). (Level of Evidence: B)

Noninvasive Testing in Known SIHD—Asymptomatic (or Stable Symptoms)

See Table 21 in the original guideline document for a summary of recommendations from this section.

Class IIa

1. Nuclear MPI, echocardiography, or CMR with either exercise or pharmacological stress can be useful for follow-up assessment at 2-year or longer intervals in patients with SIHD with prior evidence of silent ischemia or who are at high risk for a recurrent cardiac event and a) are unable to exercise to an adequate workload, b) have an *un*interpretable ECG, or c) have a history of incomplete coronary revascularization (American College of Cardiology Foundation et al., 2011; Hendel et al., 2009; American College of Cardiology Foundation Appropriate Use Criteria Task Force et al., 2011). (Level of Evidence: C)

Class IIb

1. Standard exercise ECG testing performed at 1-year or longer intervals might be considered for follow-up assessment in patients with SIHD who have had prior evidence of silent ischemia or are at high risk for a recurrent cardiac event and are able to exercise to an adequate workload and have an interpretable ECG. (Level of Evidence: C)
2. In patients who have no new or worsening symptoms or no prior evidence of silent ischemia and are not at high risk for a recurrent cardiac event, the usefulness of annual surveillance exercise ECG testing is not well established. (Level of Evidence: C)

Class III: No Benefit

1. Nuclear MPI, echocardiography, or CMR, with either exercise or pharmacological stress or CCTA, is not recommended for follow-up assessment in patients with SIHD, if performed more frequently than at a) 5-year intervals after CABG or b) 2-year intervals after PCI (American College of Cardiology Foundation et al., 2011; Hendel et al., 2009; American College of Cardiology Foundation Appropriate Use Criteria Task Force et al., 2011). (Level of Evidence: C)

Definitions:

Applying Classification of Recommendations and Level of Evidence

		Size of Treatment Effect				
		CLASS I *Benefit >>> Risk* Procedure/Treatment SHOULD be performed/ administered	CLASS IIa *Benefit >> Risk Additional studies with focused objectives needed* IT IS REASONABLE to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment MAY BE CONSIDERED	CLASS III *No Benefit* or Class III *Harm*	
					Procedure/Test	**Treatment**
					COR III: No Benefit	Not helpful	No proven benefit
					COR III: Harm	Excess Cost without Benefit or Harmful	Harmful to Patients
Estimate of Certainty (Precision) of Treatment Effect	LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	• Recommendation that procedure or treatment is useful/effective • Sufficient evidence from multiple randomized trials or meta-analyses	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Sufficient evidence from multiple randomized trials or meta-analyses	
	LEVEL B Limited populations evaluated* Data derived from a single randomized clinical trials or nonrandomized studies	• Recommendation that procedure or treatment is useful/effective • Evidence from single randomized trial or nonrandomized studies	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Evidence from single randomized trial or nonrandomized studies	
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies or standard of care	• Recommendation that procedure or treatment is useful/effective • Only expert opinion, case studies, or standard of care	• Recommendation in favor of treatment or procedure being useful/effective • Only diverging expert opinion, case studies, or standard of care	• Recommendation's usefulness/efficacy less well established • Only diverging expert opinion, case studies, or standard of care	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Only expert opinion, case studies, or standard of care	

A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use.

Clinical Algorithm(s)

The following algorithms are provided in the original guideline document:

- Diagnosis of Patients with Suspected Ischemic Heart Disease (SIHD)
- Algorithm for Risk Assessment of Patients with Stable SIHD
- Algorithm for Guideline-Directed Medical Therapy for Patients with SIHD
- Algorithm for Revascularization to Improve Survival of Patients with SIHD
- Algorithm for Revascularization to Improve Symptoms of Patients with SIHD

Scope

Disease/Condition(s)

Ischemic heart disease

Other Disease/Condition(s) Addressed

- Chronic kidney disease
- Depression
- Diabetes mellitus
- Heart failure
- Hypertension
- Tobacco dependence

Guideline Category

Counseling

Diagnosis

Evaluation

Management

Prevention

Risk Assessment

Screening

Treatment

Clinical Specialty

Cardiology

Family Practice

Geriatrics

Internal Medicine

Nephrology

Nursing

Nutrition

Preventive Medicine

Radiology

Thoracic Surgery

Intended Users

Advanced Practice Nurses

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

To assist healthcare providers in clinical decision making by describing a range of generally acceptable approaches to the diagnosis, management, and prevention of stable ischemic heart disease

Target Population

- Adult patients with stable known or suspected ischemic heart disease (IHD), including new-onset chest pain (i.e., low-risk unstable angina [UA])
- Adult patients with stable pain syndromes, including patients who have "ischemic equivalents," such as dyspnea or arm pain with exertion
- Asymptomatic patients who were previously symptomatic, including those who have undergone percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG)
- Asymptomatic patients with stable ischemic heart disease (SIHD) that has been diagnosed solely on the basis of an abnormal screening study

Note: The following populations are beyond the scope of this guideline:

Patients with acute myocardial infarction (AMI) or moderate- to high-risk UA
Patients with IHD who develop recurrent chest pain if evaluation demonstrates that IHD is unlikely to cause the symptoms (i.e., noncardiac causes)
Asymptomatic patients who are at risk for IHD but who are not known to have IHD
Patients with chest pain symptoms early after revascularization by either percutaneous techniques or CABG (i.e., within 6 months of revascularization)
Patients with chest pain syndromes after cardiac transplantation
Pediatric patients

Interventions and Practices Considered

Diagnosis/Evaluation/Risk Assessment

1. Shared decision-making between patient and provider in choices made on diagnostic and therapeutic options
2. Clinical evaluation (history, physical examination, risk assessment in patients presenting with angina)
3. Resting electrocardiography (ECG)
4. Standard exercise ECG
5. Exercise stress testing with nuclear myocardial perfusion imaging (MPI) or echocardiography
6. Pharmacological stress testing with nuclear MPI, echocardiography, or cardiac magnetic resonance (CMR) imaging
7. Cardiac/coronary computed tomography angiography (CCTA)
8. Noncontrast cardiac computed tomography (CT)
9. Coronary angiography

Prevention/Treatment/Management

1. Individualized patient education and treatment plan
2. Lipid management
    - Lifestyle modification
    - Dietary therapy
    - Statin or other cholesterol-lowering therapy
3. Blood pressure management
    - Lifestyle modification
    - Antihypertensive drug therapy
4. Diabetes management with a goal hemoglobin A1c (HbA1c) of 7% or less
5. Physical activity counseling and cardiac rehabilitation
6. Weight management
7. Smoking cessation counseling and treatment
8. Screening for and treatment of depression
9. Moderation of alcohol consumption
10. Avoidance of exposure to air pollution
11. Antiplatelet therapy (aspirin, clopidogrel)
12. Beta-blocker therapy
13. Renin-angiotensin-aldosterone blocker therapy
14. Annual influenza vaccination
15. Anti-ischemic medications
    - Beta-blockers
    - Calcium channel blockers
    - Long-acting nitrates

- Sublingual nitroglycerin or nitroglycerin spray
- Ranolazine

16. Alternative therapies for relief of symptoms
    - Enhanced external counterpulsation
    - Spinal cord stimulation
    - Transmyocardial revascularization (TMR)
17. Revascularization using a Heart Team approach
    - Coronary artery bypass graft (CABG)
    - Percutaneous coronary intervention (PCI)
    - TMR performed as an adjunct to CABG
    - Hybrid coronary revascularization
18. Patient follow-up with monitoring of symptoms and antianginal therapy

Note: Estrogen therapy; vitamin C, vitamin E, and beta-carotene supplementation; treatment of elevated homocysteine with folate or vitamins B6 and B12; chelation therapy; garlic; coenzyme Q10; selenium; and chromium were considered but not recommended as risk reduction therapies. Acupuncture was considered but not recommended as an alternative therapy for relief of symptoms.

Major Outcomes Considered

- Accuracy, sensitivity, specificity, and positive and negative predictive value of diagnostic tests
- Prognostic value of tests
- Risk of ischemic heart disease (IHD) and other cardiovascular diseases and conditions
- Risk of cardiac events
- Mortality
- Morbidity
- Survival
- Effectiveness of treatment
- Changes in risk factors for heart disease
- Health status, including severity of symptoms, functional limitations, and quality of life
- Adverse events associated with treatment
- Safety of treatment
- Cost-effectiveness

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

An extensive evidence review was conducted as the document was compiled through December 2008. Repeated literature searches were performed by the guideline development staff and writing committee members as new issues were considered. New clinical trials published in peer-reviewed journals and articles through December 2011 were also reviewed and incorporated when relevant. Furthermore, because of the extended development time period for this guideline, peer review comments indicated that the sections focused on imaging technologies required additional updating, which occurred during 2011. Therefore, the evidence review for the imaging sections includes published literature through December 2011.

Searches were limited to studies, reviews, and other evidence in human subjects and that were published in English. Searches were conducted using PubMed and the Cochrane Collaboration Database. Key search words included but were not limited to the following: *accuracy, angina, asymptomatic patients, cardiac magnetic resonance (CMR), cardiac rehabilitation, chest pain, chronic angina, chronic coronary occlusions, chronic ischemic heart disease (IHD), chronic total occlusion, connective tissue disease, coronary artery bypass graft (CABG) versus medical therapy, coronary artery disease (CAD) and exercise, coronary calcium scanning, cardiac/coronary computed tomography angiography (CCTA), CMR angiography, CMR imaging, coronary stenosis, death, depression, detection of CAD in symptomatic patients, diabetes, diagnosis, dobutamine stress echocardiography, echocardiography, elderly, electrocardiogram (ECG) and chronic stable angina, emergency department, ethnic, exercise, exercise stress testing, follow-up testing, gender, glycemic control, hypertension, intravascular ultrasound, fractional flow reserve (FFR), invasive coronary angiography, kidney disease, low-density lipoprotein (LDL) lowering, magnetic resonance imaging (MRI), medication adherence, minority groups, mortality, myocardial infarction (MI), noninvasive testing and mortality, nuclear myocardial perfusion, nutrition, obesity, outcomes, patient follow-up, patient education, prognosis, proximal left anterior descending (LAD) disease, physical activity, reoperation, risk stratification, smoking, stable ischemic heart disease (SIHD), stable angina and reoperation, stable angina and revascularization, stress echocardiography, radionuclide stress testing, stenting versus CABG, unprotected left main, weight reduction, and women*.

The writing committee used current and credible meta-analyses, when available, instead of conducting a systematic review of all primary literature.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Applying Classification of Recommendations and Level of Evidence

		Size of Treatment Effect					
		CLASS I *Benefit >>> Risk* Procedure/Treatment SHOULD be performed/ administered	CLASS IIa *Benefit >> Risk Additional studies with focused objectives needed* IT IS REASONABLE to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment MAY BE CONSIDERED	CLASS III *No Benefit* or Class III *Harm*		
						Procedure/Test	**Treatment**
					COR III: No Benefit	Not helpful	No proven benefit
					COR III: Harm	Excess Cost without Benefit or Harmful	Harmful to Patients
Estimate of Certainty (Precision) of Treatment Effect	LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	• Recommendation that procedure or treatment is useful/effective • Sufficient evidence from multiple randomized trials or meta-analyses	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Sufficient evidence from multiple randomized trials or meta-analyses		
	LEVEL B Limited populations evaluated* Data derived from a single randomized clinical trials or nonrandomized studies	• Recommendation that procedure or treatment is useful/effective • Evidence from single randomized trial or nonrandomized studies	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Evidence from single randomized trial or nonrandomized studies		
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies or standard of care	• Recommendation that procedure or treatment is useful/effective • Only expert opinion, case studies, or standard of care	• Recommendation in favor of treatment or procedure being useful/effective • Only diverging expert opinion, case studies, or standard of care	• Recommendation's usefulness/efficacy less well established • Only diverging expert opinion, case studies, or standard of care	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Only expert opinion, case studies, or standard of care		

A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

To provide clinicians with a comprehensive set of data, the absolute risk difference and number needed to treat or harm, if they were published and their inclusion was deemed appropriate, are provided in the guideline, along with confidence intervals and data related to the relative treatment effects, such as odds ratio, relative risk, hazard ratio, or incidence rate ratio.

In analyzing the data and developing recommendations and supporting text, the writing committee uses evidence-based methodologies developed by the Task Force. The Level of Evidence (LOE) is an estimate of the certainty or precision of the treatment effect. The writing committee reviews and ranks evidence supporting each recommendation, with the weight of evidence ranked as LOE A, B, or C according to specific definitions (see the "Rating Scheme for the Strength of the Evidence" field). Studies are identified as observational, retrospective, prospective, or randomized as appropriate.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Experts in the subject under consideration are selected by the American College of Cardiology Foundation (ACCF) and American Heart Association (AHA) to examine subject-specific data and write guidelines in partnership with representatives from other medical organizations and specialty groups. Writing committees are asked to perform a literature review; weigh the strength of evidence for or against particular tests, treatments, or procedures; and include estimates of expected outcomes where such data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that may influence the choice of tests or therapies are considered. When available, information from studies on cost is considered, but data on efficacy and outcomes constitute the primary basis for the recommendations in these guidelines.

In analyzing the data and developing recommendations and supporting text, the writing committee uses evidence-based methodologies developed by the Task Force. The Class of Recommendation (COR) is an estimate of the size of the treatment effect, with consideration given to risks versus benefits as well as evidence and/or agreement that a given treatment or procedure is or is not useful/effective or in some situations may cause harm. The Level of Evidence (LOE) is an estimate of the certainty or precision of the treatment effect. The writing committee reviews and ranks evidence supporting each recommendation, with the weight of evidence ranked as LOE A, B, or C according to specific definitions that are included in the "Rating Scheme for the Strength of the Evidence" field. Studies are identified as observational, retrospective, prospective, or randomized as appropriate. For certain conditions for which inadequate data are available, recommendations are based on expert consensus and clinical experience and are ranked as LOE C. When recommendations at LOE C are supported by historical clinical data, appropriate references (including clinical reviews) are cited if available. For issues for which sparse data are available, a survey of current practice among the clinicians on the writing committee is the basis for LOE C recommendations, and no references are cited. The schema for COR and LOE is summarized in the "Rating Scheme for the Strength of the Evidence" field. Table 1 in the original guideline document provides suggested phrases for writing recommendations within each COR. A new addition to this methodology is separation of the Class III recommendations to delineate whether the recommendation is determined to be of "no benefit" or is associated with "harm" to the patient. In addition, in view of the increasing number of comparative effectiveness studies, comparator verbs and suggested phrases for writing recommendations for the comparative effectiveness of one treatment or strategy versus another have been added for COR I and IIa, LOE A or B only.

In view of the advances in medical therapy across the spectrum of cardiovascular diseases, the Task Force has designated the term *guideline-directed medical therapy (GDMT)* to represent optimal medical therapy as defined by ACCF/AHA guideline (primarily Class I)–recommended therapies. This new term, *GDMT*, is used in this guideline and throughout all future guidelines.

The writing committee was composed of physicians, cardiovascular interventionalists, surgeons, general internists, imagers, nurses, and pharmacists. The writing committee included representatives from the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons.

General Approach and Overlap with Other Guidelines or Statements

The original guideline overlaps with numerous clinical practice guidelines published by the ACCF/AHA Task Force on Practice Guidelines; the National Heart,

Lung, and Blood Institute; and the American College of Physicians (see Table 3 in the original guideline document). To maintain consistency, the writing committee worked with members of other committees to harmonize recommendations and eliminate discrepancies. Some recommendations from earlier guidelines have been updated as warranted by new evidence or a better understanding of earlier evidence, whereas others that were no longer accurate or relevant or were overlapping were modified; recommendations from previous guidelines that were similar or redundant were eliminated or consolidated when possible.

Most of the topics mentioned in the present guideline were addressed in the "ACC/AHA 2002 Guideline Update for the Management of Patients with Chronic Stable Angina—Summary Article," and many of the recommendations in the present guideline are consistent with those in the 2002 document. Whereas the 2002 update dealt individually with specific drugs and interventions for reducing cardiovascular risk and medical therapy of angina pectoris, the present document recommends a combination of lifestyle modifications and medications that constitute GDMT. In addition, recommendations for risk reduction have been revised to reflect new evidence and are now consistent with the "AHA/ACCF Secondary Prevention and Risk Reduction Therapy for Patients with Coronary and Other Atherosclerotic Vascular Disease: 2011 Update." Also in the present guideline, recommendations and text related to revascularization are the result of extensive collaborative discussions between the percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG) writing committees, as well as key members of the stable ischemic heart disease (SIHD) and unstable angina/non-ST-segment elevation myocardial infarction (UA/NSTEMI) writing committees. In a major undertaking, the PCI and CABG guidelines were written concurrently with input from the STEMI guideline writing committee and additional collaboration with the SIHD guideline writing committee, allowing greater collaboration between these writing committees on revascularization strategies in patients with coronary artery disease (CAD) (including unprotected left main PCI, multivessel disease revascularization, and hybrid procedures). Section 5 of the original guideline document is included as published in both the PCI and CABG guidelines in its entirety.

The writing committee recognized that it would be unfeasible to produce a document that would be simultaneously practical and exhaustive and, therefore, has tried to create a resource that provides a comprehensive approach to management of stable ischemic heart disease (SIHD) for which the relevant evidence is succinctly summarized and referenced. The writing committee used current and credible meta-analyses, when available, instead of conducting a systematic review of all primary literature.

Rating Scheme for the Strength of the Recommendations

See the "Rating Scheme for the Strength of the Evidence" field, above.

Cost Analysis

See Section 2.2.1.5 in the original guideline document for a discussion of the cost-effectiveness of noninvasive testing for diagnosis of ischemic heart disease.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

This document was reviewed by two external reviewers nominated by both the American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA); two reviewers nominated by the American College of Physicians (ACP), American Association for Thoracic Surgery (AATS), Preventive Cardiovascular Nurses Association (PCNA), Society for Cardiovascular Angiography and Interventions (SCAI), and Society of Thoracic Surgeons (STS); and 19 content reviewers, including members of the ACCF Imaging Council, ACCF Interventional Scientific Council, and the AHA Council on Clinical Cardiology. Reviewers' relevant relationships with industry or other entities (RWI) information was collected and distributed to the writing committee and is published in Appendix 2 of the original guideline document. Because extensive peer review comments resulted in substantial revision, the guideline was subjected to a second peer review by all official and organizational reviewers. Lastly, the imaging sections were peer reviewed separately, after an update to that evidence base.

This document was approved for publication by the governing bodies of the ACCF, AHA, ACP, AATS, PCNA, SCAI, and STS.

Evidence Supporting the Recommendations

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Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate and effective diagnosis and management of patients with stable ischemic heart disease

Potential Harms

- All forms of noninvasive stress testing carry some risk. Maximal exercise testing is associated with a low but finite incidence of cardiac arrest, acute myocardial infarction (AMI), and even death. Refer to Section 2.2.1.2 in the original guideline document, "Safety and Other Consideration Potentially Affecting Test Selection," for a detailed discussion of safety issues associated with testing.
- All medical therapy used to prevent myocardial infarction or to relieve symptoms can cause adverse effects. Refer to the original guideline document for

discussions of specific benefits and risks of antiplatelet therapy, beta-blockers, renin-angiotensin-aldosterone blocker therapy, nitrates, calcium channel blockers, and other antianginal therapy.
- Percutaneous coronary intervention (PCI) may increase the short-term risk of myocardial infarction (MI).
- Procedural stroke occurred more commonly with coronary artery bypass graft (CABG) than with PCI.
- The risk of stent thrombosis is increased dramatically in patients who prematurely discontinue dual antiplatelet therapy (DAPT), and stent thrombosis is associated with a mortality rate of 20% to 45%.
- Pharmacotherapy is more difficult in older adults because of changes in drug bioavailability and elimination. Drug–drug interactions are more common because of polypharmacy. A more conservative approach to coronary angiography is often appropriate given the higher risk of contrast-induced nephropathy in older adults. Moreover, the risks of morbidity and mortality associated with CABG are increased in older adults.
- The incidence of periprocedural complications (e.g., death, MI, stroke, infection, renal failure) is higher in patients with chronic kidney disease than in those without renal dysfunction.

Contraindications

Contraindications

- Contrast agents can affect renal function and therefore should be avoided in patients with chronic kidney disease.
- Cardiac magnetic resonance (CMR) might be contraindicated in patients with claustrophobia or implanted devices, and use of gadolinium contrast agents is associated rarely with nephrogenic systemic fibrosis. For this reason, gadolinium is contraindicated in patients with severe renal dysfunction (estimated glomerular filtration rates <30 mL/min per 1.73 m^2), and the dose should be adjusted for patients with mild to moderate dysfunction (estimated glomerular filtration rates 30 to 60 mL/min per 1.73 m^2).
- The use of bile acid sequestrant is relatively contraindicated when triglycerides are ≥200 mg/dL and is contraindicated when triglycerides are ≥500 mg/dL
- Aspirin is relatively contraindicated in patients with known allergies to nonsteroidal antiinflammatory drugs and in patients with the syndrome of asthma, rhinitis, and nasal polyps.
- Absolute contraindications to beta blockers are severe bradycardia, preexisting high-degree atrioventricular (AV) block, sick sinus syndrome (without a pacemaker in place), and refractory heart failure. Relative contraindications include bronchospastic disease or active peripheral artery disease (PAD) (beta blockers without vasodilating properties or selective agents at low doses may be used).
- Because of their effects on contractility, none of the calcium channel blockers are recommended for routine treatment of patients with current or prior symptoms of heart failure and a reduced left ventricular ejection fraction (LVEF).
- Combining verapamil or diltiazem with beta blockers generally should be avoided because of potentially profound adverse effects on AV nodal conduction, heart rate, or cardiac contractility.
- Nitrates are relatively contraindicated in hypertrophic obstructive cardiomyopathy because of the potential to increase the outflow tract obstruction and mitral regurgitant flow. They should be avoided in patients with severe aortic valvular stenosis.
- Coadministration of the phosphodiesterase inhibitors sildenafil, tadalafil, or vardenafil with long-acting nitrates should be strictly avoided within 24 hours of nitrate administration because of the risk of profound hypotension (e.g., 25–mm Hg drop in systolic blood pressure). Patients should be advised not to take phosphodiesterase inhibitors within 24 hours of long-acting nitrates, and nitrates should not be taken for 24 hours after use of sildenafil or 48 hours after tadalafil; a suitable time interval after vardenafil has not been determined.
- Ranolazine is contraindicated in patients with clinically significant hepatic impairment because of increased plasma concentrations and QT prolongation.
- Ranolazine is contraindicated in combination with potent inhibitors of the CYP3A4 pathway, including ketoconazole (3.2-fold increase in ranolazine plasma levels) and other azole antifungals, macrolide antibiotics, human immunodeficiency virus (HIV) protease inhibitors, grapefruit products or juice, diltiazem (1.8- to 2.3-fold increase in ranolazine plasma levels), itraconazole, clarithromycin, and certain HIV protease inhibitors.
- Contraindications to enhanced external counterpulsation include decompensated heart failure, severe PAD, and severe aortic regurgitation.

Qualifying Statements

Qualifying Statements

- The American College of Cardiology Foundation (ACCF)/American Heart Association (AHA) practice guidelines are intended to assist healthcare providers in clinical decision making by describing a range of generally acceptable approaches to the diagnosis, management, and prevention of specific diseases or conditions. The guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment about care of a particular patient must be made by the healthcare provider and patient in light of all the circumstances presented by that patient. As a result, situations may arise in which deviations from these guidelines might be appropriate. Clinical decision making should involve consideration of the quality and availability of expertise in the area where care is provided. When these guidelines are used as the basis for regulatory or payer decisions, the goal should be improvement in quality of care. The Task Force recognizes that situations arise in which additional data are needed to inform patient care more effectively; these areas will be identified within each respective guideline when appropriate.
- Prescribed courses of treatment in accordance with these recommendations are effective only if followed. Because lack of patient understanding and

adherence may adversely affect outcomes, physicians and other healthcare providers should make every effort to engage the patient's active participation in prescribed medical regimens and lifestyles.

- A key premise of this guideline is that once a diagnosis of ischemic heart disease (IHD) is established, it is necessary in most patients to assess their risk of subsequent complications, such as acute myocardial infarction (AMI) or death. Because the approach to diagnosis of suspected IHD and the assessment of risk in a patient with known IHD are conceptually different and are based on different literature, the writing committee constructed this guideline to address these issues separately. It is recognized, however, that a clinician might select a procedure for a patient with a moderate to high pretest likelihood of IHD to provide information for both diagnosis and risk assessment, whereas in a patient with a low likelihood of IHD, it could be sensible to select a test simply for diagnostic purposes without regard to risk assessment. By separating the conceptual approaches to ascertaining diagnosis and prognosis, the goal of the writing committee is to promote the sensible application of appropriate testing rather than routine use of the most expensive or complex tests whether warranted or not. It is not the intent of the writing committee to promote unnecessary or duplicate testing, although in some patients this could be unavoidable.
- Additionally, this guideline addresses the approach to asymptomatic patients with stable ischemic heart disease (SIHD) that has been diagnosed solely on the basis of an abnormal screening study, rather than on the basis of clinical symptoms or events such as anginal symptoms or acute coronary syndrome (ACS). The inclusion of such asymptomatic patients does not constitute an endorsement of such tests for the purposes of screening but is simply an acknowledgment of the clinical reality that asymptomatic patients often present for evaluation after such tests have been performed. Multiple ACCF/AHA guidelines and scientific statements have discouraged the use of ambulatory monitoring, treadmill testing, stress echocardiography, stress myocardial perfusion imaging (MPI), and computed tomography (CT) scoring of coronary calcium or coronary angiography as routine screening tests in asymptomatic individuals. The reader is referred to these documents for a detailed discussion of screening, which is beyond the scope of this guideline (see Table 3 in the original guideline document).
- The writing committee readily acknowledges that in actual clinical practice, the elements comprising the four sections of the original guideline document and the steps delineated in the algorithms often overlap and are not always separable.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Clinical Algorithm

Quick Reference Guides/Physician Guides

Resources

Slide Presentation

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Patient-centeredness

Identifying Information and Availability

Bibliographic Source(s)

Fihn SD, Gardin JM, Abrams J, Berra K, Blankenship JC, Dallas AP, Douglas PS, Foody JM, Gerber TC, Hinderliter AL, King SB 3rd, Kligfield PD, Krumholz HM, Kwong RY, Lim MJ, Linderbaum JA, Mack MJ, Munger MA, Prager RL, Sabik JF, Shaw LJ, Sikkema JD, Smith CR Jr, Smith SC Jr, Spertus JA, Williams SV. 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease. J Am Coll Cardiol. 2012 Dec 18;60(24):e44-e164. [1266 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2012 Dec 18

Guideline Developer(s)

American Association for Thoracic Surgery - Medical Specialty Society

American College of Cardiology Foundation - Medical Specialty Society

American College of Physicians - Medical Specialty Society

American Heart Association - Professional Association

Preventive Cardiovascular Nurses Association - Medical Specialty Society

Society for Cardiovascular Angiography and Interventions - Medical Specialty Society

Society of Thoracic Surgeons - Medical Specialty Society

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American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

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Financial Disclosures/Conflicts of Interest

The Task Force makes every effort to avoid actual, potential, or perceived conflicts of interest that may arise as a result of industry relationships or personal interests among the members of the writing committee. All writing committee members and peer reviewers of this guideline were required to disclose all such current health care-related relationships, including those existing 24 months (from 2005) before initiation of the writing effort. The writing committee chair may not have any relevant relationships with industry or other entities (RWI); however, RWI are permitted for the vice chair position. In December 2009, the American College of Cardiology Foundation (ACCF) and American Heart Association (AHA) implemented a new policy that requires a minimum of 50% of the writing committee to have no *relevant* RWI; in addition, the disclosure term was changed to 12 months before writing committee initiation. The present guideline was developed during the transition in RWI policy and occurred over an extended period of time. In the interest of transparency, the writing committee provides full information on RWI existing over the entire period of guideline development, including delineation of relationships that expired more than 24 months before the guideline was finalized. This information is included in Appendix 1 of the original guideline document. These statements are reviewed by the Task Force and all members during each conference call and meeting of the writing committee and are updated as changes occur. All guideline recommendations require a confidential vote by the writing committee and must be approved by a consensus of the voting members. Members who recused themselves from voting are indicated in the list of writing committee members, and specific section recusals are noted in Appendix 1 of the original guideline document. Authors' and peer reviewers' RWI pertinent to this guideline are disclosed in Appendixes 1 and 2 of the original guideline document, respectively. Comprehensive disclosure information for the Task Force is also available from the American College of Cardiology Web site .

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the Journal of the American College of Cardiology (JACC) Web site and from the Circulation Web site .

Print copies: Available from the ACC, 2400 N Street NW, Washington DC, 20037; (800) 253-4636 (US only).

Availability of Companion Documents

The following are available:

- Fihn SD, Gardin JM, Abrams J, Berra K, Blankenship JC, Dallas AP, Douglas PS, Foody JM, Gerber TC, Hinderliter AL, King SB 3rd, Kligfield PD, Krumholz HM, Kwong RY, Lim MJ, Linderbaum JA, Mack MJ, Munger MA, Prager RL, Sabik JF, Shaw LJ, Sikkema JD, Smith CR Jr, Smith SC Jr, Spertus JA, Williams SV. 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease: executive summary. J Am Coll Cardiol 2012 Dec 18;60(24):2564-2603. Electronic copies: Available in Portable Document Format (PDF) from the Journal of the American College of Cardiology (JACC) Web site .
- 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease: Slide set. 2012. 164 p. Electronic copies: Available from the American College of Cardiology (ACC) Web site .
- Top ten things to know. Guideline for the diagnosis and management of patients with stable ischemic heart disease: 2012. 1 p. Electronic copies: Available from the American Heart Association (AHA) Web site .
- 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease: Ten Points to Remember. Electronic copies: Available from the ACC Web site with a subscription to CardioSource.
- Methodology manual and policies from the ACCF/AHA Task Force on Practice Guidelines. 2010 Jun. 88 p. Electronic copies: Available in Portable Document Format (PDF) from the AHA Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on March 26, 2013. The information was verified by the guideline developer on May 15, 2013.

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